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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/549,865	07/28/2006	Victor Higgs	NAN165 US (8037)	4772

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EXAMINER	
AKANBI, ISIAKA O	

ART UNIT	PAPER NUMBER
2886	

MAIL DATE	DELIVERY MODE
12/03/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/549,865	HIGGS, VICTOR	
	Examiner	Art Unit	
	ISIAKA O. AKANBI	2886	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 August 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 5-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5-19* is/are rejected.

7)☒ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 September 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *02 October 2008, 15 September 2008, 10 September 2008, 04 September 2008 and 27 Augut 2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Amendment

The amendment filed on 27 August 2008 has been entered into this application. Claim 4 is cancelled.

Information Disclosure Statement

The information disclosure statement filed on 02 October 2008, 15 September 2008, 10 September 2008, 04 September 2008 and 27 August 2008 has been entered and considered by the examiner.

Drawings

The drawings filed on 22 September 2005, has been accepted for examination.

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 5-13 are rejected under 35 U.S.C. 102(b) as being anticipated by Higgs (WO 02/29883 A1).

Regarding claims 1 and 5, Higgs discloses a method of detecting surface particulate defects, and especially metal particulates, in semiconductors such as silicon,

to characterise defects likely to have an effect on the electrical activity of such semiconductor materials, comprises the steps of:

annealing (excited using laser excitation (to increase the energy (i.e. heat or power of semiconductor)(Annealing = a heat treatment that alters the microstructure of a material (i.e. semiconductor such as glass) causing changes in properties such as strength and hardness) and contaminated, and then/after the levels of contamination is confirmed, detected or determined for different images **(figs. 1-4)(page 17, [pars, 0067-0069])**, **and thus meet the limitations** annealing a semiconductor structure to diffuse contaminants from a surface particulate into the semiconductor material; and (claim 5) wherein the exposing, collecting and processing steps are performed prior to and subsequent to the annealing step and the results compared to determine the difference and obtain an indication of rates of diffusion so as to identify the contaminant;

after annealing the semiconductor structure (excited using laser excitation (to increase the energy (i.e. heat or power of semiconductor), exposing the surface of the semiconductor structure in the vicinity of a surface particulate to at least one high-intensity beam of light from a suitable light source (i.e. laser)**(fig. 5: 3-8)([pars. 0045-0046]);**

collecting photoluminescence produced by excitation of the semiconductor structure by the light beam **(see, abstract, [pars. 0012, 0037, 0058] and page 20, lines 7-9);**

processing/analyzing **(the signal)** the collected photoluminescence to produce a result representative of the intensity of the photoluminescence response **(fig. 5: 40)([pars. 0062], page 20, lines 9-11);**

Higgs further discloses inspecting **(to examine carefully and critically, to examine (two or more objects, ideas, people, etc.) in order to note similarities and differences, especially for flaws)** the map for one or more regions of enhanced PL intensity, identifying characteristic (near) surface metal contamination; and inspecting for one or more regions of enhanced PL intensity identifying potential front side or back side diffusable metal contamination; and verifying by additional tests **(See abstract, lines 6-9, [pars. 0012, 0037] page 20, lines 9-11 and page 22, lines 26-28)**, and **thus meet the limitation** comparing (**to examine**) the result with a predetermined acceptable specification range of photoluminescence to identify unacceptable contamination levels resulting from diffusion of contaminants from the surface particulate into the semiconductor structure.

As to claim 2, Higgs also discloses inspecting **(to examine carefully and critically, to examine (two or more objects, ideas, etc.) in order to note similarities and differences, especially for flaws)** the map for one or more regions of enhanced PL intensity, identifying characteristic (near) surface metal contamination **(See abstract, lines 6-9, [pars. 0012, 0037] page 20, lines 9-11 and page 22, lines 26-28);** Higgs further discloses that use of the equipment enables localisation and characterisation of certain PL characteristic metal contaminants in semiconductors ([par. 0064, screen= to select, reject, consider, or group (people, objects, ideas, etc.) by examining

systematically]); which is a systematic grouping of semiconductor or silicon structure based on the analysis **and thus constitutes** a quality classification of the semiconductor structure based upon such a comparison, and rejecting or selecting for remedial action semiconductor structures exhibiting a photoluminescence response outside the said predetermined acceptable specification range.

As to claim 3, Higgs also discloses using yield test to determined device performance and reliability (page 1, [par. 0002]), and thus meet the limitations a prior step of determining a predetermined acceptable specification from studies of samples of fabricated devices using electrical yield test methods.

As to claims 6, 7 and 13, Higgs also discloses a method of detecting surface particulate defects, and especially metal particulates, in semiconductors such as silicon, to characterise defects likely to have an effect on the electrical activity of such semiconductor materials, comprises:

a first step of collecting photoluminescence by:

exposing the surface of the semiconductor structure in the vicinity of a surface particulate to at least one high-intensity beam of light from a suitable light source **(i.e. Laser)(page 21, lines 14-15)(fig. 5: 3-8)([pars. 0012, 0037, 0045-0046]);**

collecting photoluminescence produced by excitation of the semiconductor structure by the light beam **(see abstract, lines 4-6)([pars. 0012, 0037, 0045-0046]);**;

processing/analyzing **(the signal)** the collected photoluminescence to produce a first photoluminescence result representative of the intensity of the photoluminescence response **(fig. 5: 40)([pars. 0062], page 20, lines 9-11);**

Higgs further discloses exposing the semiconductor or contaminated silicon wafers to excitation beam, producing a image mapping the location of the particulates as a dark field image of light scattered from the surface the semiconductor structure **(figs. 1-5)** and collecting luminescence **(after excitation=second step)** from the structure in the form of a PL map and inspecting **(to examine carefully and critically, to examine (two or more objects, ideas, people, etc.) in order to note similarities and differences between contaminated and the control semiconductor, especially for flaws)** for one or more regions of enhanced PL intensity identifying potential front side or back side diffusable metal contamination **(pars. 0016, 0037, 0064-0068);** and **thus meet the limitations such as** a heating step to the semiconductor to diffuse contaminant from the particle into the semiconductor material; a second step of collecting photoluminescence produced by like method to the first to produce a second photoluminescence result representative of the intensity of the photoluminescence response as above described after annealing; a step of comparing the results of each photoluminescence step to determine the difference and obtain an indication of rates of diffusion so as to identify the contaminant.

As to claims 8, 9 and 10, Higgs discloses the limitations wherein the spatial resolution of the laser is 0.1 to 20 μm **(page 21, lines 26-27)**; wherein the laser provides a peak or average power density of between 10^4 to 10^9 watts/cm^2 **(page 22, lines 4-7) and** wherein the light beam used to generate the PL effect is so controlled as to Collect PL information from no deeper than the upper **(i.e. 12 μm)** of the semiconductor structure **(page 22, lines 1-2)([par. 0033-0034]).**

As to claim 11, Higgs discloses the limitation a first step of locating surface particulates using a suitable particulate imaging method, and a subsequent or simultaneous second step of generating PL intensity information from the vicinity of each particulate to provide a quantification of the extent to which contaminant has diffused from the particulate into the near-surface region of the semiconductor **(figs. 1-5)([pars. 0012, 0062]).**

As to claim 12, Higgs discloses the limitation wherein the particulate imaging, mapping and locating method comprises the generation of a scattered light dark field image and/or a reflected light bright field image **(figs. 1-5)(see abstract)([pars. 0012, 0062]).**

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 14, 15 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Higgs (WO 02/29883 A1) in view of Maris (2002/0054295 A1).

Regarding claims 14 and 15, Higgs discloses an apparatus of detecting surface particulate defects, and especially metal particulates, in semiconductors such as silicon,

to characterise defects likely to have an effect on the electrical activity of such semiconductor materials, comprises a support for a semiconductor sample under test;

a high intensity light source **(fig. 5: 3-8)[par. 0045];**

means **(fig. 5: 30)** to focus a high intensity beam of light from the light source **(fig. 5: 3-8)** onto a surface of a semiconductor sample **(fig. 5: 2)** under test on the support **(fig. 5: 1)[par. 0048]**;

collection means **(fig. 5: 34)** to collect photoluminescence data produced by excitation of the semiconductor structure by the light beam at least in the vicinity of particulates on the surface thereof **(see, abstract, [pars. 0012, 0037, 0058] and page 20, lines 7-9);**

means **(fig. 5: 40)** to process the collected data**(the signal)** to produce a result representative of the intensity of the photoluminescence response in the said vicinity;

means **(fig. 5: 40)** for processing/analyzing **(the signal)** the collected photoluminescence data to produce a result representative of the intensity of the photoluminescence response **([pars. 0062], page 20, lines 9-11);**

Higgs further discloses inspecting **(to examine carefully and critically, to examine (two or more objects, ideas, people, etc.) in order to note similarities and differences, especially for flaws)** the map for one or more regions of enhanced PL intensity, identifying characteristic (near) surface metal contamination; and inspecting for one or more regions of enhanced PL intensity identifying potential front side or back side diffusable metal contamination; and verifying by additional tests **(See abstract, lines 6-9, [pars. 0012, 0037] page 20, lines 9-11 and page 22, lines 26-28)**, and **thus**

meet the limitation comparing (**to examine**) the result with a predetermined acceptable specification range of photoluminescence to identify unacceptable contamination levels resulting from diffusion of contaminants from the surface particulate into the semiconductor structure.

Higgs discloses annealing (excited using laser excitation (to increase the energy (i.e. heat or power of semiconductor)(Annealing = a heat treatment that alters the microstructure of a material (i.e. semiconductor such as glass) causing changes in properties such as strength and hardness) and contaminated, and then/after the levels of contamination is confirmed, detected or determined for different images **(figs. 1-4)(page 17, [pars, 0067-0069])**.

Higgs is silent regarding means to heat the sample under test associated with the support to diffuse contamination from a particulate into a semiconductor structure of the sample under test or heating means to heat the sample in situ, allowing a photoluminescence response to be measured before and after heating

Maris from the same field of endeavor teaches of a heating means embedded in a sample stage for anneal process (fig. 1A-E: 122) [pars. 0039, 0075 and 0095].

Therefore it would have been at least obvious to one having ordinary skill in the art at the time of invention to modify Higgs by means to heat the sample under test associated with the support (stage) which allow a photoluminescence response to be measured before and after heating for the purpose of effectively diffuse away from the surface into the interior of the semiconductor structure of the sample under test contamination/annealing/doping substance, as per the teachings of Maris.

Claims 16, 17, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Higgs (WO 02/29883 A1) in view of Noguchi et al. (6,730,594 B2).

As to claim 16, Higgs teaches of an apparatus for detecting surface particulate defects, and especially metal particulates, in semiconductors such as silicon, to characterise defects likely to have an effect on the electrical activity of such semiconductor materials, comprises:

a high intensity light source **(fig. 5: 3-8)([pars. 0045-0046]);**;

means **(fig. 5: 30 and 34)** to focus a high intensity beam of light from the light source onto a surface of a semiconductor sample under test on the support **([par. 0048]);**;

collection means **(fig. 5: 14, 34, 31)** to collect photoluminescence data produced by excitation of the semiconductor structure by the light beam at least in the vicinity of particulates on the surface **(fig. 5: 2)** thereof;

means **(fig. 5: 25 and 29)** to process the collected data to produce a result representative of the intensity of the photoluminescence response in the said vicinity **([pars. 0050-51]);**

a microprocessor **(fig. 5: 40)** includes a comparator to compare **(to examine carefully and critically, to examine (two or more objects, ideas, people, etc.) in order to note similarities and differences between contaminated and the control**

semiconductor, especially for flaws) the said two photoluminescence responses to determine the difference and obtain an indication of rates of diffusion so as to identify the contaminant **([pars. 0016, 0037, 0064-0068 and 0062], page 20, lines 9-11).**

Higgs fails to explicitly specify a means to heat the sample in situ, allowing a photoluminescence response to be measured before and after heating.

Noguchi from the same field of endeavor teaches heating means **(fig. 4: H) (col. 8, lines 27-32).**

Therefore it would have been at least obvious to one having ordinary skill in the art at the time of invention to modify Higgs by means to heat the sample in situ for the purpose of controlling the temperature of the sample with accuracy.

As to claim 17, Higgs teaches excitation of a semiconductor which is a process of increasing the energy (i.e. heat or power) of semiconductor.

Higgs fails to explicitly specify a means to heat the sample under test is associated with the support or the heating means comprises a heated stage.

However, using a measuring stage or support that is associated with heating means is common and know in the art, as evidenced by Noguchi **(fig. 4: H) (col. 8, lines 27-32).**

Therefore it would have been at least obvious to one having ordinary skill in the art at the time of invention to modify Higgs by associated a heating means with the support or a heating means comprising a heated stage for the purpose of controlling the temperature of the sample with accuracy, as per the teachings of Noguchi.

As to claims 18 and 19, Higgs discloses the limitations that including imaging means **(figs. 5: 25 and 29)** to create an image map of the location of particulates on the surface of the semiconductor structure **(fig. 5: 2);** and wherein the imaging means generates a scattered light dark field and/or a reflected light image **(figs. 1-4)**.

Response to Arguments

Applicant's arguments/remarks, (see pages 7-10), filed on 27 August 2008, with respect to the rejection(s) of claim(s) 1-9 and 14-19 and the objection of claims 10-13 have been fully considered but are not persuasive.

In response to Applicant's arguments that Higgs does not teach or suggest in particular limitations such as "annealing the semiconductor structure" and "comparing the result.., to identify unacceptable contamination levels resulting from diffusion of contaminants from the surface particulate into the semiconductor structure", as recited in the instant claim 1. It is respectfully pointed out to applicant that this argument is not persuasive as Higgs clearly disclose in **(page 17, [pars, 0067-0069])** and shows in **(figs. 1-4)** (**annealing (excited using laser excitation (to increase the energy (i.e. heat or power of semiconductor)(Annealing = a heat treatment that alters the microstructure of a material (i.e. semiconductor such as glass) causing changes in properties such as strength and hardness)).** Further Higgs clearly discloses in **(See abstract, lines 6-9, [pars. 0012, 0037] page 20, lines 9-11 and page 22, lines 26-28)** inspecting **(to examine carefully and critically, to examine (two or more objects, ideas, people, etc.) in order to note similarities and differences,**

especially for flaws) and inspecting for one or more regions of enhanced PL intensity identifying potential front side or back side diffusable metal contamination meeting the claim limitations of claim 1.

In response to Applicant's arguments with respect to the rejection(s) of claim(s) 15-17 under 35 U.S.C. 103(a), it is respectfully pointed out to applicant that this argument is not persuasive, as the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). Additionally, In response to Applicant's arguments that Noguchi does not teach or suggest measuring the sample before and after heating as recited in claim 16, Applicant's attention is respectfully requested to the rejection of claim 16, the examiner did recognize that the limitation "heating means to heat the sample in situ", was not taught by Higgs but used Noguchi to find this limitation. Finally, as to amended claims 14 and 15, upon consideration, a rejection is made as detailed above.

Additional Prior Art

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The references listed in the attached form PTO-892 teach of

other prior art method of detecting surface particulate defects, and especially metal particulates, in semiconductors such as silicon, to characterise defects likely to have an effect on the electrical activity of such semiconductor materials that may anticipate or obviate the claims of the applicant's invention.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Isiaka Akanbi whose telephone number is (571) 272-8658. The examiner can normally be reached on 8:00 a.m. - 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tarifur R. Chowdhury can be reached on (571) 272-2287. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Isiaka Akanbi

November 22, 2008

/TARIFUR R CHOWDHURY/

Supervisory Patent Examiner, Art Unit 2886